AC102 Datasheet

High Performance and Low Power Mono Audio CODEC

Revision 0.7

Apr, 10, 2018

REVISION HISTORY

Revision	Data	Author	Description
V0.1	Nov,20,2017		Initial Version
V0.2	Nov,30,2017		Complete Version 0.2
V0.3	Dec,15,2017		Complete Version 0.3
V0.4	Dec,18,2017		Complete Version 0.4
V0.5	Dec,26,2017		Complete Version 0.5
V0.6	Mar,19,2018		Complete Version 0.6
V0.7	Apr,10,2018		Complete Version 0.7

DECLARATION

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CONTENTS

High Performance and Low Power Mono Audio CODEC

Features

■ ADC

- Mono ADC with 100dB SNR typically(A-weight);
- –82 dB THD+N @ 0 dB boost and 1.0Vpp input;
- Mono Fully-differential analog microphone input with 0dB~31dB boost amplifier gain;
- ADC sample rates supported: 8k, 11.025k, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48kHz;
- Programmable Microphone Bias 1.81V~2.39V;
- Support Automatic Gain Control (AGC) adjusting the ADC recording output;

■ DAC

- Mono DAC with 105dB SNR typically(A-weight);
- –85 dB THD+N @ 0dB;
- Mono Fully-differential Line Output with 1.0Vrms maxium output voltage;
- DAC sample rates supported: 8k, 11.025k, 16kHz, 22.05kHz, 24kHz, 32kHz, 44.1kHz, 48kHz;
- 3 bands programmable Biquads filter for EQ in DAC path;

■ System

- One TWI control interface up to 400 kHz;
- One 8KHz ~ 48KHz I2S/PCM interface;
- Adjustable 44.1K/48K sample rate without software driver;
- 2 Integrated LDOs，analog LDO output is 1.8V，digital LDO output is 1.2V;
- 3 mm x 3 mm 20-pin QFN Package，pitch 0.4mm;

■ Low Power

- Support single 1.8V or 3.3V power supply;
- < 5mA Mono 48ksps ADC Record with fully-differential analog microphone input;
- < 5mA Mono 48ksps DAC Playback with lineout driver output;

Description

The AC102 is a high-performance, low-power, mono audio codec optimized for use in portable applications. The device integrates support one fully-differential analog microphone input and mono line output driver.

The mono 24-bit multi-bit sigma delta ADC with digital decimation filters has programmable gain with automatic gain control (AGC). Digital audio output word length from 8-24 bits and sampling rates from 8kHz to 48kHz are supported.

A multi-bit sigma delta DAC is used with digital audio input word length from 8-24 bits and sampling rates from 8 to 48kHz. The mono 3-stage biquad filter can be used to provide more flexible filtering of the output signal than can be achieved using the 3-band equalizer. The biquad filters can be used for the implementation of low-pass, high-pass or notch filters.

The device provides many formats of serial audio data interface to the input of the DAC or output from the ADC through LRCK, BCLK and SDIN/SDOUT pins. These formats are I2S, left justified, right justified, PCM and TDM mode.

AC102 is controlled through TWI (2-wire serial interface). The clock supports up to 400 KHz rate. It works only in the slave mode.

Applications

- Portable audio applications
- Wireless headset
- Digital Cameras and video cameras
- Tablets and eBooks

Functional Block Diagram

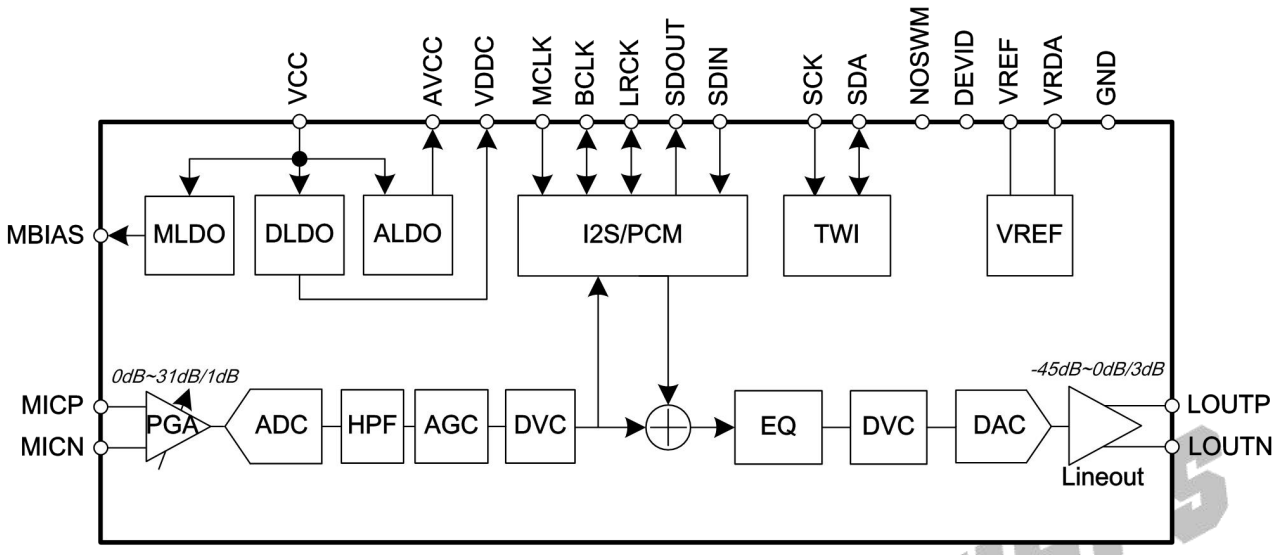


Figure 1 Functional Block Diagram

Pin Assignment

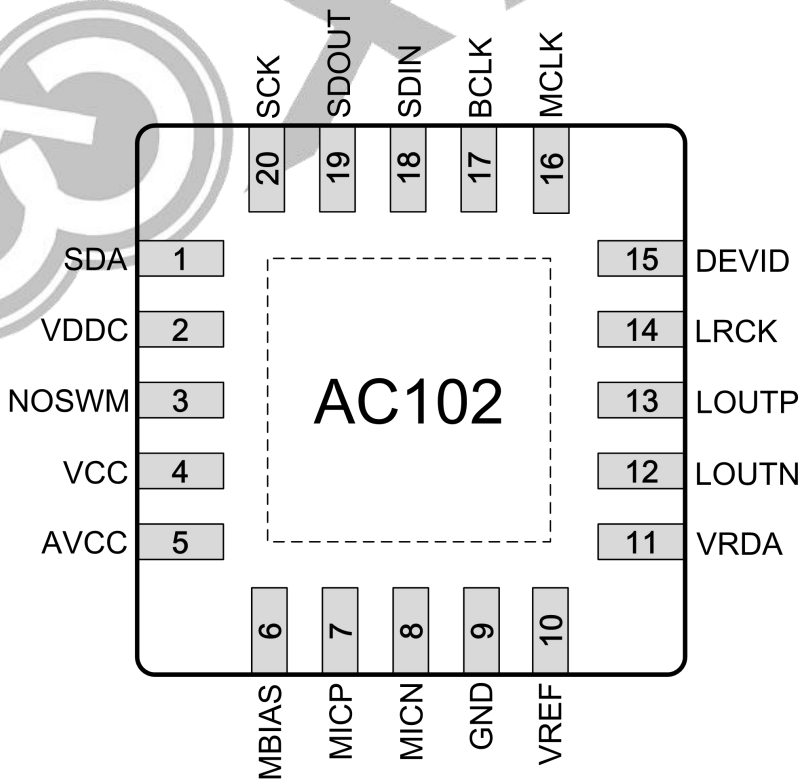


Figure 2 Pin Assignment

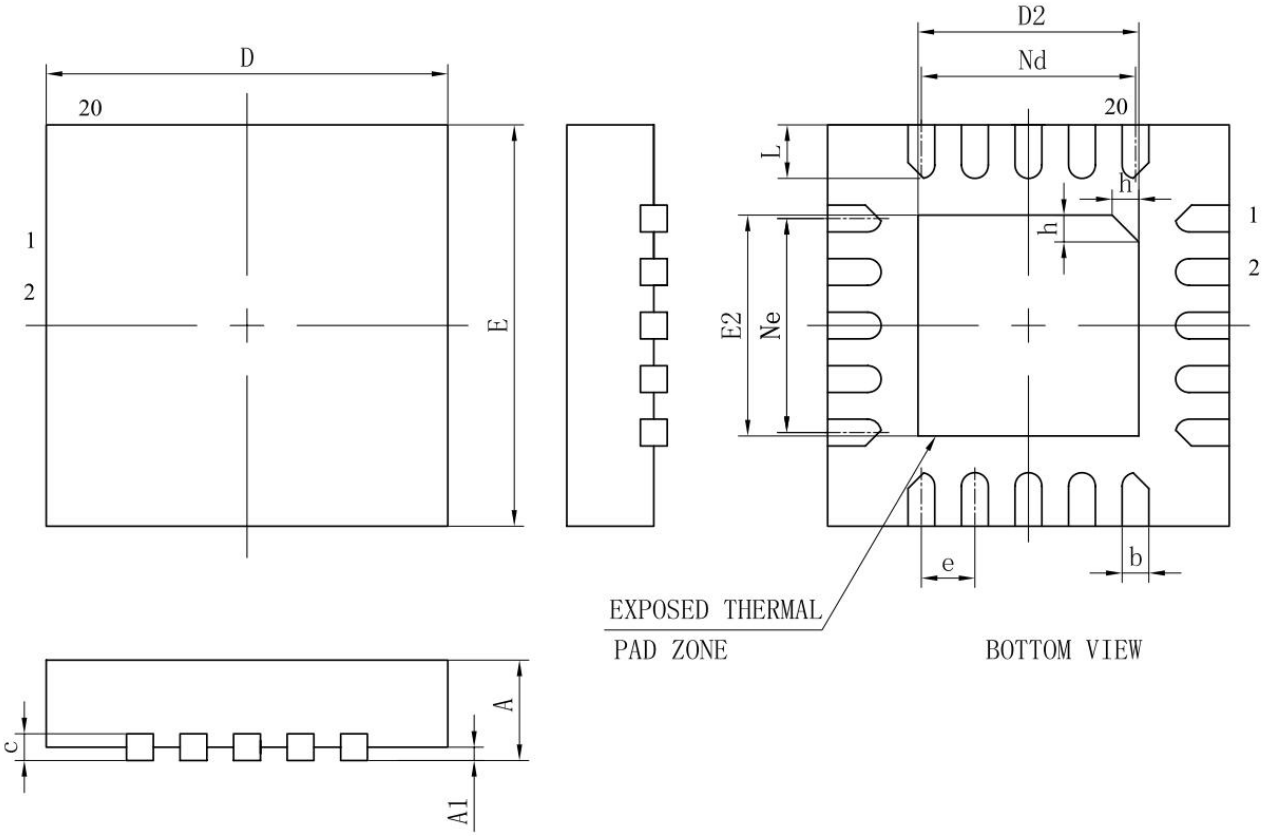
Pin Description

This chapter describes the 20 pins of AC102 from four aspects: pin number, signal name, type, and pin definition. All the pins are classified into four groups, including digital IO pin, analog IO pin, filter/reference, and power/ground.

There are five pin types here: O for output, I for input, I/O for input/output, P for power, and G for ground.

Pin Number	Signal Name	Type	Description
Digital IO Pins （9-pins）			
20	SCK	I	TWI interface serial clock input(Open-drain)
1	SDA	I/O	TWI interface serial data(Open-drain)
3	NOSWM	I	No software driver mode on
14	LRCK	I/O	I2S interface synchronous clock
15	DEVID	I	TWI interface device ID control
16	MCLK	I	I2S interface master input clock
17	BCLK	I/O	I2S interface serial bit clock
18	SDIN	I	I2S interface serial data input
19	SDOUT	O	I2S interface serial data output
Analog IO Pin （4-pins）			
7	MICP	I	Positive differential input for MIC
8	MICN	I	Negative differential input for MIC
12	LOUTN	O	Differential negative output to lineout amplifier
13	LOUTP	O	Differential positive output to lineout amplifier
Reference（2-pins）			
10	VREF	O	Internal reference voltage for ADC and DAC.
11	VRDA	O	Internal reference voltage for DAC.
Power/Ground （6-pins）			
2	VDDC	P	The DLDO Power output 1.2V for digital part
4	VCC	P	The DLDO&ALDO Power input, also supply for digital IO
5	AVCC	P	The ALDO Power output 1.8V for analog part
6	MBIAS	P	The MLDO output for microhpone
9	GND	G	Chip ground
21	-	-	EPAD (NC)

Package Dimension



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0. 70	0.75	0. 80
A1	—	0. 02	0. 05
b	0. 15	0. 20	0. 25
c	0. 18	0. 20	0. 25
D	2. 90	3. 00	3. 10
D2	1. 55	1. 65	1. 75
e	0. 40BSC		
Ne	1. 60BSC		
Nd	1. 60BSC		
E	2. 90	3. 00	3. 10
E2	1. 55	1. 65	1. 75
L	0. 35	0. 40	0. 45
h	0. 20	0. 25	0. 30

Figure 3 Package Dimension

Electrical Characteristics

Absolute Maximum Ratings

Absolute maximum ratings are stress ratings only. Permanent damage to the device may be caused by continuously operating at or beyond these limits. Device functional operating limits and guaranteed performance specifications are given under electrical characteristics at the test conditions specified.

Symbol	Parameter	MIN	MAX	Unit
VCC	Digital power for digital I/O buffer (I2S&TWI) and supply for inner DLDO&ALDO.	-0.3	3.63	V
AVCC	Analog power for Audio CODEC.	-0.3	1.98	V
MBIAS	Analog power for microphone bias, it can be generate by inner MLDO.	-0.3	3.63	V
T_A	Operating Ambient Temperature.	-40	85	℃
V_{ESD}	ESD	4	--	KV

Recommended Operating Conditions

Parameter	Description	MIN	TPY	MAX	Unit
VCC	Digital power for digital I/O buffer (I2S&TWI)..	1.62	3.3	3.63	V
VDDC	Digital power for Audio digital core, it is generated by inner DLDO	1.08	1.2	1.98	V
AVCC	Analog power for Audio CODEC, it is generated by inner ALDO.	1.62	1.8	1.98	V
MBIAS	Analog power for microphone bias, it can be generate by inner MLDO.	1.8	2.39	3.63	V
GND	Ground reference	--	0	--	V

Static Characteristics

Symbol	Parameter	Test condition	Min	Typical	Max	Units
V_{IN}	Input Voltage Range	--	-0.3	--	VCC+0.3 VCC+0.3	V
V_{IH}	High Level Input Voltage	VCC=3.3V	2.4	--	3.6	V
		VCC=1.8V	1.4	--	1.98	
V_{IL}	Low Level Input Voltage	VCC=3.3V	-0.3	--	0.7	V
		VCC=1.8V	-0.3	--	0.7	
V_{OH}	High Level Input Voltage	VCC=3.3V	2.7	--	NA	V
		VCC=1.8V	1.5	--	NA	
V_{OL}	Low Level Input Voltage	VCC=3.3V	NA	--	0.4	V
		VCC=1.8V	NA	--	0.4	
I_{OZ}	Tri-state Output Leakage Current	--	TBD	TBD	TBD	uA
C_{IN}	Input Capacitance	--	NA	NA	5	pF
C_{OUT}	Output Capacitance	--	NA	NA	5	pF

Analog Performance Characteristics

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UINT
ADC Input Path Performance	**MIC via ADC to I2S VCC=3.3V, AVCC=1.8V, VDDC=1.2V**					
	SNR(A-weighted)	PGA Gain=0 dB	97	100		dB
	THD+N (1.0Vpp 1KHz input)		-80	-82		dB
DAC Output Path Performance	**DAC to Lineout on LOUTP and LOUTN VCC=3.3V, AVCC=1.8V, VDDC=1.2V**					
	Full-Scale Output Level (Fully-differential output)	0dBFS 1KHz input	0.9	1.0		Vrms
	SNR(A-weighted)	0dBFS 1KHz input	102	105		dB
	THD+N	0dBFS 1KHz input	-82	-85		dB

Typical Power Consumption

Default Test Conditions:

VCC=3.3V, ALDO and DLDO enable, VDDC=1.2V, AVCC=1.8V

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UINT
ADC Input Path Performance	**MIC via ADC to I2S VDDIO=3.3V, AVCC=1.8V, VDDC=1.2V**					
	ADC Record Power consumption	PGA Gain=0 dB		5		mA
DAC Output Path Performance	**DAC to Lineout on LOUTP and LOUTN VCC=3.3V, AVCC=1.8V, VDDC=1.2V**					
	DAC Playback Power consumption	0dBFS 1KHz input		5		mA

Typical Application Diagram

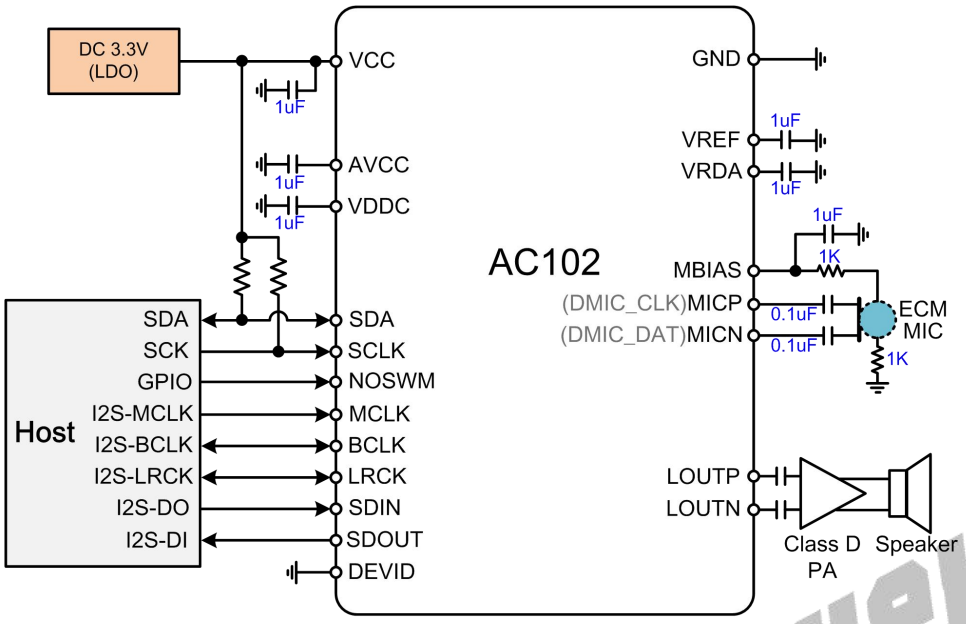


Figure 4 Single 3.3V Supply Typical Application Diagram

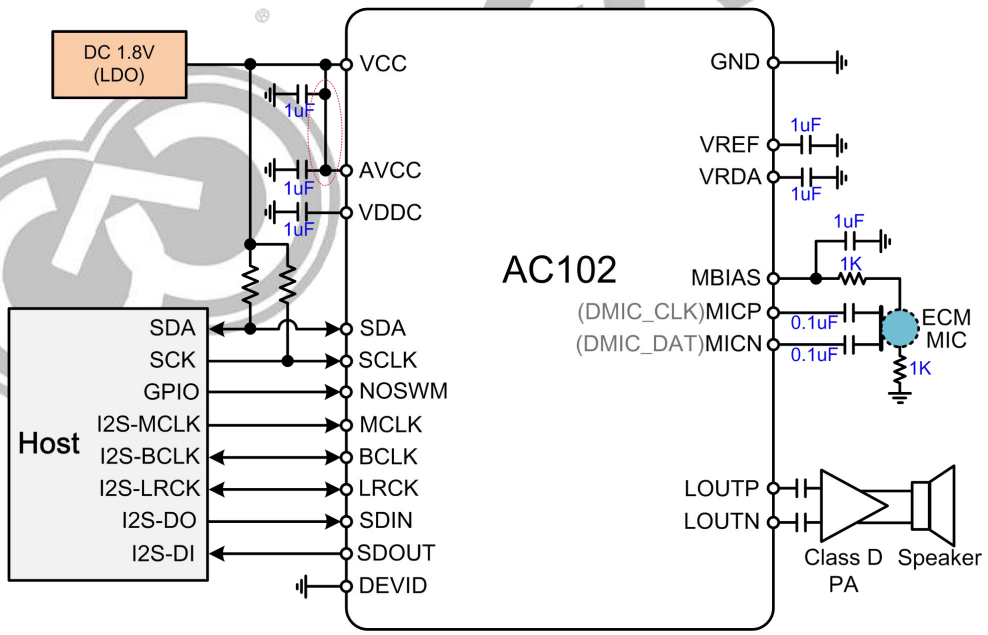


Figure 5 Single 1.8V Supply Typical Application Diagram